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FOUNDRY TRADE JOURNAL
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Vol. 71 Thursday, October 7, 1943 No. 1416

Maintenance and Design

There has been much intelligent propaganda broadcast in recent times dealing with the necessity of systematic supervision of plant so as to preclude the possibility of a loss of production through the breakdown of machinery. Breakdowns are normally classified under three headings:—(1) Lack of adequate maintenance; (2) abuse by operators; and (3) unsuitable design or faulty manufacture. The first job of any executive charged with the maintenance of plant is to make an analysis of every job undertaken by his own staff or those delegated to it by his colleagues. Experience has shown that in large works 34 per cent. of breakdowns can be debited to the second cause, yet we are convinced that by devoting proper attention to factors 1 and 3, breakdowns due to abuse by operatives should become almost negligible. To cite two cases coming within our own personal experience will emphasise this aspect. Probably due to the lack of regular oiling, a voltage selector gear operated by a handwheel became fixed in between two tappings. Whilst we were finding the maintenance electrician, the melter, anxious not to allow a heat of steel to cool in the furnace, put in the main switch and burnt out a transformer. The furnace was down for repairs for about six weeks. This is a case where the abuse would not have happened if maintenance had been satisfactory.

The second case, which was a continuous source of worry to us, related to the mechanism for regulating the movements of the electrodes in one of the earliest types of melting furnaces. In this case, after experiencing innumerable breakdowns, we told the engineering staff—not in editorial language—that even though it involved a shut-down of a week, or a month, or a year, a workmanlike job must be produced, that is, one which would not constantly be breaking down. The result was a completely new and trouble-free design. Naturally, before such strong steps could be taken, we had prepared a schedule of lost production due to this particular cause. Moreover, we are convinced that the enlightened manufacturers of foundry plant would welcome maintenance reports on the machines they supply, because by this means they would learn of the weak points in the design. According to one foundry executive who has had under his charge what is probably the largest aggregation of moulding machines in the country, those embodying what he deemed to be the cleverest design, were insufficiently robust to withstand high-speed manufacturing conditions. Here, then, is a case where the probability is that the furnishing of properly marshalled data from the users would enable the admittedly brilliantly designed machines to give improved and adequate service. How true this is, is well borne out by the inquiries we receive from time to time as to the possibility of procuring spare parts for certain Continental designs of machines. We would advise all foundry owners to keep a record as to the man-hours spent on the maintenance of each machine and, as soon as this reaches a predetermined percentage of the purchase price of the machine in any one year, to report to the suppliers. Moreover, the compilation of such data would be helpful in presenting an intelligent case to Somerset House, when obsolescence is being related to income-tax assessments. One foundry manager has consistently throughout the war shut down his mechanised plant on Saturday mornings, despite pressure from the "office," in order that the machines should function, trouble-free, for five days a week, and his output records are impressive! There has been, perhaps, too little recognition of the fact that, with the changeover of the foundry, during the last two decades, from an aggregation of handicrafts into a huge manufacturing industry, there is need for a well organised maintenance department in every establishment.

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KETTLES FOR HOLDING LIQUID ZN AL ALLOYS

Mr. Leonard C. Costello, writing in the "Iron Age," suggests that for melting and holding batches of Kirksite "A" zinc-aluminium alloy with low (380 deg. C.) melting point iron kettles of the following composition should be used:—T.C, 3.0 to 3.5; Si, 1.0 to 2.0; Mn, 0.60 to 0.75; Ni, 2.0 to 2.5; Cr, 1.1 to 1.2, and Mo, 0.4 to 0.6 per cent. Pots of this composition should be normalised at 650 to 760 deg. C. for 4 hrs. and allowed to cool slowly for at least 12 hrs. and preferably 40 hrs. to room temperature. The inner surface should be ground smooth before normalising, as apparently no reliance is placed on casting skin as is the case in some techniques. In this composition, the Mn, Ni and Cr are present to refine the grain and so reduce the rate of solution of the iron in alloy, whilst the Mo toughens the structure so that it can better resist the heat shock incident to the rapid change in temperature on starting up. Welded kettles are not recommended.

Before putting into commission, the kettle is cleaned, heated to about 100 deg. C., and iron oxide solution is applied in at least three coats for protection against the solvent action of the alloy. The pot is emptied after 200 to 300 hrs. of operation, when the coating is renewed. When the melting pot is shut down, a skull of the alloy is allowed to remain, and embedded in it is a lifting hook, thereby providing an easy way of emptying the kettle, using an overhead crane. The sides of the kettle may carry some alloy which is peeled off, and where this is impossible an oxy-acetylene burner is used. The kettle is then warmed and re-coated with the iron oxide solution, which can also be used for the protection of surfaces of skimmers, pyrometers, shanks and other tools.

NOTES FROM THE BRANCHES

London—The first of a series of three lectures especially designed to interest members in the Slough area was held on September 29 in the Lecture Theatre of High Duty Alloys, Limited. Mr. T. Makemson, secretary of the Institute, presided, and the lecturer was Mr. G. E. France, of Halifax, who dealt with the fundamental principles of mechanisation. A good discussion followed, in which Mr. Faulkner, Mr. Templeton, Mr. Warrington, Mr. Rayboult, and Mr. Payne took part. Mr. France was thanked by Mr. Logan, and Mr. Makemson by Mr. Logan and Mr. Pike. About 70 members and visitors were present. In order that the development work now being undertaken in the Slough area may have full local support, the Council has appointed Mr. E. John Pike, High Duty Alloys, Limited, as honorary assistant secretary.

STILL MORE PAPER FOR THE SCRAP

AL ALLOY SUBSTITUTION CHART

To further the efficient use of aluminium scrap in casting, the (American) War Production Board has issued a chart to indicate possible alloy substitutions by which greater amounts of scrap can be utilised. The "Aluminium Casting Alloy Substitution Chart" was prepared by the W.P.B. Conservation Division, and points out that remelted scrap ingot not only forms a significant part of the aluminium supply, but also already contains many of the critical alloying elements needed. The chart considers sand, gravity die and ordinary casting alloys separately, and possible substitutions are suggested by four progressively lower purity alloy specifications. The three lower classifications are "primary ingot and/or high purity segregated scrap," "segregated scrap with required pure blending" and "mixed and obsolescent scrap."

THE FOUNDRY INDUSTRY AND AIR WARFARE—IV

(*Continued from page* 106.)

side the shop to fill a 10-ton hopper located over the railway sidings. The dust arising at the knock-out is dealt with exactly as was described for the mould knock-out, a single Buell separator unit and fan driven by 60 h.p. being installed and arranged to discharge the repected fine dust to the railway wagons.

Core Making

For core making circular turntables are used, on which are disposed three sections of the corebox. The first section deals with the placing of the prepared core bar into the lower part of the corebox, a short portion of which is rammed by hand. In the second position, a specially designed machine rams the main body of core, the process involving the rotation of the corebox by means of a piston clutch. At the third point on the turntable the upper part of the core is rammed by means of a small pneumatic rammer. These three processes are carried on simultaneously, rendering the system continuous.

When the completely rammed core reaches the first position, the corebox is opened, and the core is transferred by means of a specially designed jib crane, carrying a balance weight equal to the weight of the core, to a circular plate from which the cores are suspended. The plate is attached to a rotating tube mounted on a mild-steel bogie. Each bogie carries ten cores, and the three women "manning" each station fill one every forty minutes.

The perforated tubular core bars are mechanically wrapped with wood wool on a battery of vertical machines. The wrapped bars are then suspended on to an overhead chain conveyor and singed. The conveyor, which has a 538-ft. circuit, takes the bars within easy reach of the coremakers.

(*To be continued.*)

THE FOUNDRY INDUSTRY AND AIR WARFARE—IV

THE MASS PRODUCTION OF AERIAL BOMBS

Technical Account of Equipment and Practice at a British Foundry Casting 500-lb. Bombs with Maximum Steel Scrap and Minimum Ferro-Silicon

This article describes a practice used for the mass-production of green-sand moulded 500-lb. bombs, using a maximum of steel scrap and a minimum of ferro-silicon. The unquestionable success of the system was based on a new theory for the operation of the side-blown converter; the synchronisation of mould assembly and other jobs with the time taken to pour a predetermined number of castings and a new system of sand cooling. The theory postulates the quite tenable and now well proved notion that silicon as a constituent of the charge is unnecessary, provided the metal is superheated to a temperature equivalent to that existing in the vessel when the carbon begins to react with the oxygen of the bath. In the case cited, this superheating of the cupola metal is carried out in pulverised fuel fired rotary furnaces. The equally important systems of synchronisation in manufacture and sand cooling will be dealt with later.

Melting Plant Used

For the manufacture of these 500-lb. bombs a concern visited by our representative used 20-ton per hour cupolas; 12½-ton rotary furnaces; and a battery of 3½-tons capacity side-blown converters. The stock-yard, shown in Fig. 4, is covered in, and the scrap from the railway wagons is unloaded by means of 7½-ton electric overhead magnet cranes into stock bins or into the cupola charging buckets mounted on bogies running on a narrow gauge track. These

TABLE I.—*Properties of Chelford and System Sands.*

Grading on B.S.I. sieves.	Chelford new.	System sand.	Composition, per cent.	Chelford new.	System sand.
Left on 30	4	4	Silica	98·5	95·5
44	17	13	Silt	0·5	0·4
60	37	30	Clay	0·4	4·1
72	15	13			
100	20	26			
150	7	10			
Remainder	—	5			

FIG. 1.—SECTION OF PHYSICAL LABORATORY.

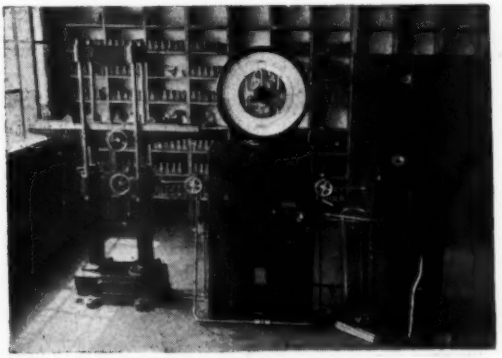


FIG. 2.—TENSILE TESTING MACHINE IN PHYSICAL LABORATORY.

Mass Production of Aerial Bombs

bogies are propelled by means of a battery-operated locomotive. The skips illustrated in Fig. 5 are of the drop-bottom type, and are lifted from the bogies by a 7½-ton electric overhead cupola charger. The coke and the limestone on arrival are dumped into track hoppers at the wharf, and are then taken by belt conveyors to conveniently situated bunkers. From here, the coke is loaded as required into a scale car, which discharges into specially designed charging buckets of the drop-bottom type.

The cupolas are blown by blast supplied by electrically driven positive displacement blowers, each unit in the battery having a capacity of 18,000 c.f.m. at a maximum pressure of 54-in. water gauge. With the object of securing a wide range of speed variation, each blower is provided with a modern type of A.C. commutator. The cupolas are fitted with a tunnel type of anti-glare spark arrestor.

The cupolas are not provided with receivers but with a deep well to facilitate carbon pickup from the coke bed. Low-phosphorus material not being essential for this particular production, the iron produced by these cupolas has the following average analysis: C, 2.7 to 2.8 per cent.; Si, 0.1 to 0.2; Mn, 0.3 to 0.5; S, 0.12 to 0.15; P, 0.06 to 0.07 per cent.

Using 30 lbs. of soda ash per ton, the sulphur is reduced to an average of 0.035 per cent., but can be reduced still further when required. The accompanying silicon loss is small and is not important to the process. The ladles in which this process is effected are firebrick lined. The metal is transferred by one of the 10 overhead cranes to the rotary furnaces, which, it will be remembered, are

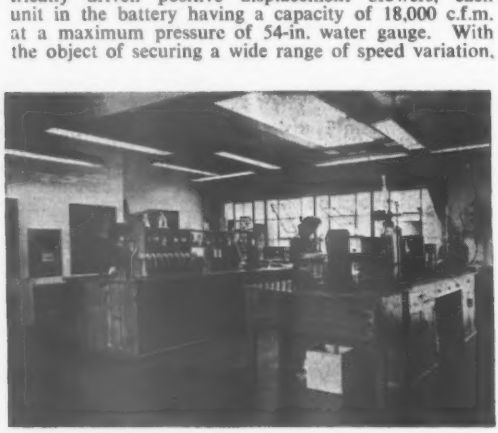


FIG. 3.—SECTION OF CHEMICAL LABORATORY.

FIG. 4.—PORTION OF STOCKYARD SHOWING SCRAP STEEL PILE.

FIG. 5.—BACK OF CUPOLAS SHOWING CHARGING SKIPS.

FIG. 6.—FRONT SIDE OF CUPOLAS.

fired by pulverised anthracite. A pulverising plant is installed in a plant situated near the converter blower house. In the rotary furnaces the temperature of the metal is raised by 200 deg. C. without change in composition. The technique of lining conservation has been so improved that at the time of our representative's visit one furnace still in commission had treated no less than 4,000 tons. Apart from superheating, these furnaces also act as mixers, and iron out any slight variations in cupola practice. From the rotary plant the metal is transferred to the side-blown acid converters.

The vessels are provided with electric tilting gear actuated by remote control. They are blown by electrically driven positive displacement blowers giving an output of 5,000 c.f.m. at a maximum pressure of 6½ lbs. per sq. in. Like the cupola blowers, these also have fitted to them modern variable speed commutators, so as to give a wide range of speed. The hoods surmounting each converter are movable, so as to facilitate the removal of the vessel from the blast ring for relining in specially prepared pits, located adjacent to those used for preparing the bodies of the rotary furnaces. The plant is well furnished with ferro-managnese crushers, ladle drying equipment, whilst adequate space is provided for brick storage. The composition of the steel leaving the converters will average: C, 0.23 to 0.25; Si, 0.3; Mn, 1.3 to 1.4; S, 0.03 to 0.04; and P, 0.06 to 0.07.

Teapot lip pouring ladles receive the metal from the converters, and they are transported by means of a 7-ton capacity loco crane to the overhead hot-metal runway. Here, they are weighed and taken by electric telpher to the pouring position alongside the mould conveyor.

The metal losses registered are of about 5 per cent. in the cupola, and 5 to 7 per cent. in the converter. Using the new technique, it was found that there was

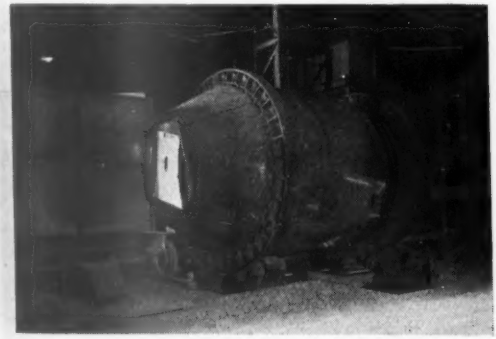


FIG. 7.—ONE OF THE TWO SESCI ROTARY FURNACES.

FIG. 8.—ONE OF THE FOUR TROPENAS CONVERTERS.

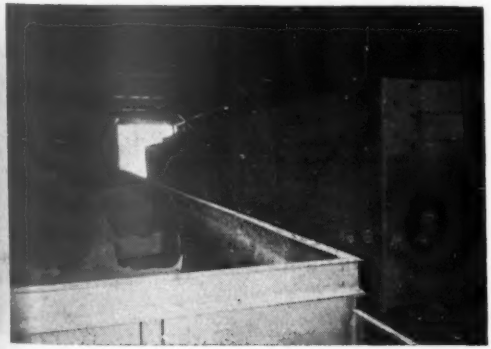


FIG. 9.—VIEW OF THE MAIN HOPPERS FOR THE NEW SAND.

FIG. 10.—INCLINED BELT CONVEYING NEW SAND TO DRYER.

Mass Production of Aerial Bombs

a fairly heavy erosion round the tuyeres of the vessels, and on the teeming side, owing to the absence of silicon in the charge. However, this was soon cured by the addition of a few shovelsful of sand. The tensile properties of the metal are of the order of M.S. 37 tons per sq. in. associated with 27 per cent. elongation on 2 in. Before machining, the bombs are subjected to a heat-treatment consisting of raising them to a temperature of 950 deg. C., soaking between this temperature and 972 for 2½ hrs., and cooling down over a period of 5½ hrs.

Sands Used

The sand used is based on Chelford, the grading of which, and that of the system sand, is shown in Table I. Between 21 and 25 per cent. of new sand has to be added to maintain the physical properties, and to replace sand taken out for coremaking, when mixed with 4 per cent. bentonite.

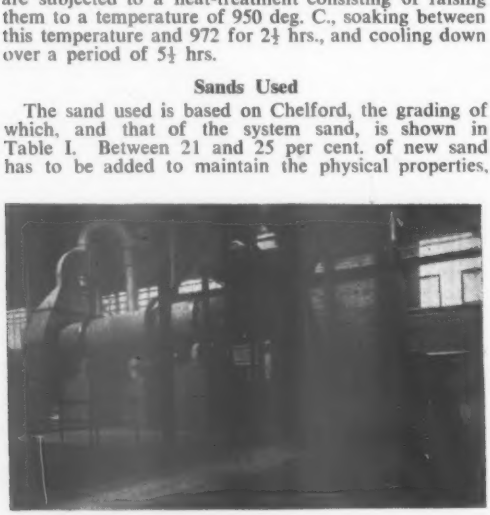


FIG. 11.—NEW SAND DRYER.

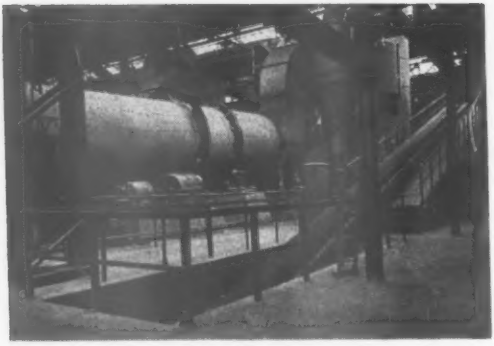


FIG. 13.—ONE OF THE ROTARY SAND COOLERS AND DUST EXTRACTION PLANT.

Sand Handling

The main source of supply comes from the knock-out grids, most of which are jolted, but some are stationary gratings. Each grid will measure about 9 ft. 6 in. or 10 ft. by 6 ft., and the sand passing through them falls on a horizontal conveyor, which feeds an inclined belt. This carries the sand past a magnetic overband separator to eliminate any metallic inclusions, and through an octagonal rotary trommel type screen of ¼-in. mesh to discharge into a 40-ton hopper. The lumps rejected from the screen fall on to a belt conveyor which carries it outside the shop to fill an overhead hopper for final removal to the dump.

Great attention has been paid to dust extraction at the knock-outs, and just below the grid surfaces there are suction manifolds. These communicate by means of large mild-steel ducts laid beneath the foundry floor to a group of fans and dust separation plants housed in an annexe to the main buildings. One fan and separator unit deals with each knock-out section. Through the action of the fans air is drawn through

FIG. 12.—SECTION OF SAND HANDLING PLANT, SHOWING NEW SAND HOPPERS IN FOREGROUND AND RECLAIMED SAND SCREEN IN BACKGROUND.

the grids; the fine dust in the sand falling from the boxes and castings to the conveyor beneath is entrained in this air and carried through the ducts and fans to the separators where it is collected in receiving hoppers arranged to discharge direct into railway wagons. Each fan is driven by a 50-h.p. motor, and each separating unit comprises four high-efficiency Buell "Micro-Lector" separators in parallel with independent chimneys discharging the de-dusted air above roof level.

New sand on arrival is shovelled into bunkers, the top edges of which are level with the railway wagons. The bunkers are housed in a separate building running parallel with the main shops. Beneath the hoppers, each unit of which has a capacity of 90 tons, is an endless belt which feeds an inclined belt running at right angles. This carries the sand into the main shop where it first passes through a rotary mechanically fired sand dryer, and thereby eliminating the important "moisture content" variable inherent in all new sands.

From this dryer the sand is automatically fed on to a second inclined belt which delivers it into a 10-ton storage hopper. The sand is taken from this hopper at opposite sides by means of two feeder belts which spill on to two long inclined belts, which also receive sand passing through the trommel screen. Gates are provided at the discharge points of these hoppers, so that predetermined ratios of reclaimed and new sand can be maintained. The mixture of old and new sand is then fed into rotary coolers.

Rotary Coolers

This plant, new to the foundry industry, consists of large (Buttner system) rotary drum coolers, each designed to handle up to 30 tons of sand per hr. The drums, which are 43 ft. long and 7 ft. 10 ins. diameter, are provided with a cruciform internal system, and mounted on two cast steel running rims and supporting rollers. They are driven by gear and pinion from a 30-h.p. motor through a three-speed reduction gearbox. Each cooler is provided with a large centrifugal fan which draws the cooling air through the drum in counter current to the sand flow. The air enters the coolers at ambient temperature, and after absorbing heat is delivered to a steel chimney stack.

FIG. 14.—BATTERY OF SAND MIXING MILLS.

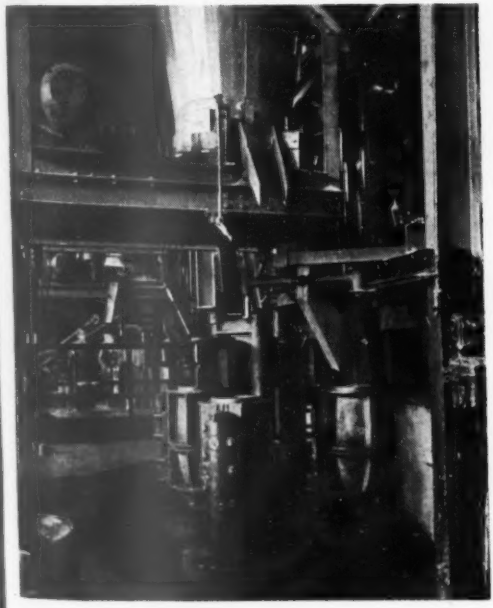


FIG. 16.—CLOSE-UP VIEW OF ONE OF THE COREMAKING MACHINES, SHOWING THE COREBOXES.

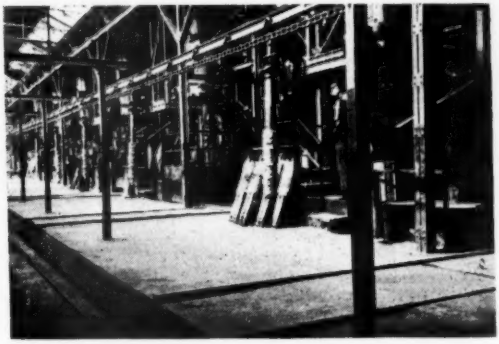


FIG. 15.—GENERAL VIEW OF THE EIGHT COREMAKING MACHINES.

Mass Production of Aerial Bombs

Between the cooler and the fan, a Micro-Lector is interposed, wherein the dust carried over in the cooling air is separated, collected and discharged by a cross conveyor, the one receiving the over-size matter from the rotary screen to discharge into a hopper located over railway wagons outside the shop.

Mixing

From the coolers the sand is collected on to an underground belt which delivers to a long inclined belt running at right angles, which elevates the sand to fill a battery of hoppers. These, by means of cross belts, feed a number of both No. 2 (1,000-lbs. capacity) and No. 3 (2,000-lbs.) August Simpson mills. The larger mills prepare moulding sand, and the smaller ones the core sand. The sand hoppers serving the mills are designed to furnish a definite quantity of sand into each mill automatically. This is accomplished by means of a trip gear controlling the feed belts which fill service hoppers located above each mill. As provision is made at each mill for the accurate measuring of loading material and water, absolute control is maintained over the physical properties of the sands used.

Moulding and Core Sand Distribution

After milling, the moulding sand is conveyed by an underground belt to a storage hopper situated well below ground; from here, by means of a feeder and a long inclined belt, the sand is conveyed to the hoppers feeding the Sandslingers. These hoppers are furnished with push-button controlled endless belts, so that the operator can start or stop the flow of sand to the impellor head. Surrounding the machines is a grating through which surplus sand falls to feed an underground belt; this discharges into an elevator feeding the belt supplying the Sandslinger hoppers.

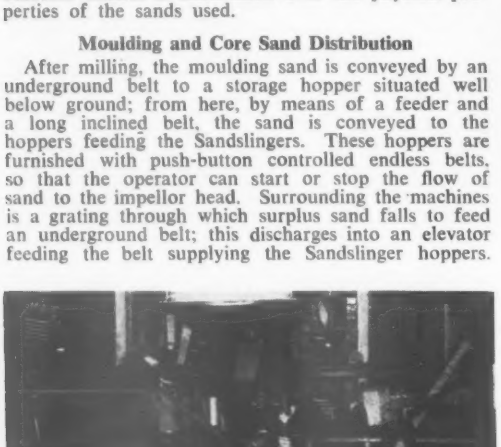


FIG. 17.—ANOTHER VIEW OF THE COREMAKING MACHINE, SHOWING COREMAKING IN PROGRESS.

Should sand be supplied in excess of the capacity of these hoppers, it is led by means of a chute and a short length of belting on to the spillage belt.

The core sand is taken away from the smaller mills by a belt conveyor running to the opposite end of the battery on the moulding sand, where it feeds an inclined belt which delivers the sand into hoppers. These hoppers have a disc as their base to prevent sticking. The sand is ploughed off this disc to fill the working hoppers. Beneath each station is a grating, so that sand dropping through it can be returned to the main supply belt by means of a spillage belt, and a short cross belt.

The core knock-out station is comprised of two stationary grids, 9 ft. by 5 ft. 6 ins., beneath which are chutes discharging the sand on to an inclined belt conveyor. This elevates the sand to a position out-

(*Continued on page* 100.)

FIG. 18.—TRANSFERRING CORES FROM THE COREMAKING MACHINE TO THE DRYING STOVE BOGIE.

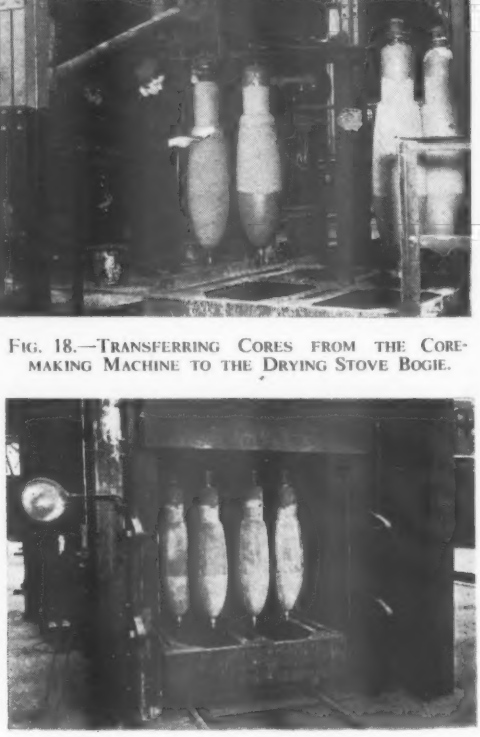


FIG. 19.—CORE BOGIE ENTERING CORE STOVE.

CONSERVATION OF FOUNDRY REFRACTORIES*

By C. E. Bales and F. McCarthy.

(*Abridged.*)

One of the essential things in efficient cupola practice is the correct type of lining and the proper method of installing it. There are many types of fireclay available for cupola block manufacture, but the best blocks are made from those clays mined in Kentucky, Missouri, and Pennsylvania. The blocks should be made by the stiff mud, machine-pressed method, as this process gives a much harder, denser block than those moulded by hand. The standard 9-in. by 6-in. by 4-in. blocks are easily made by the stiff mud method, and it has been personal experience that they are the most desirable and economical for general foundry use. Some foundries using very large cupolas prefer 9-in. by 9-in. by 4-in. blocks. These, too, can be made mechanically, but the Colliau blocks, 9 in. high, giving a 4½-in. lining, are generally always hand made.

Wherever the size of the cupola will permit it, we favour a double lining of 9-in. by 6-in. by 4-in. blocks up to the charging door. This 12-in. lining offers a number of advantages. First, there is a substantial factor of safety. If production demands it, the cupola can be stepped up to its limit without any fear of the lining burning through. It is easier to patch against a solid block lining, and, since the heat loss will be less, the operator can secure hotter iron and possibly use less coke. Between the lining and the cupola shell, a clearance of about ¼ in. is recommended to take care of the expansion of the blocks under heat. This open space can be filled with clay grouting to act as a cushion.

During the past year it has been found that cupola blocks will last longer in the well and melting zone if they are laid up with super-quality, refractory bonding mortar, instead of ordinary fireclay. This is accounted for by the fact that foundry clay usually has a lower fusion point than the block lining, it shrinks in the joints, permitting joint corrosion, and it offers very little bonding power to the lining a few inches back of the hot face. High-grade, refractory bonding mortars of the proper type have a higher fusion point than the blocks themselves; there is no joint corrosion and the lining is thoroughly bonded together. This is a definite advance in cupola lining practice. It is recommended that cupola blocks always be laid with thin close joints.

Above the charging door the use of 9-in. by 4½-in. by 2½-in. circle brick of the proper diameter to fit the shell is recommended. These bricks can be laid up in a mortar of ground fireclay. Some foundries use 9-in. straights placed on end to give a 2½-in. lining, while others use a combination of 9-in. straights and arch brick laid on end to give a 4½-in. lining. The circle brick lining is preferred, as it gives a much more substantial job and will last indefinitely.

After the cupola has been completely lined, it should be thoroughly dried out with a wood or coke fire before running the first heat. This will prevent the hard, dense, machine-made cupola blocks from spalling or flaking off. When the drying operation is completed, the cupola should then be put into operation as soon as possible.

Patching the Cupola Lining

After every heat, some patching is necessary in the melting zone and the lining in the well should be carefully examined. Clean walls are the first essential in good relining. Any humps that may have been formed above the tuyeres should be removed. It is difficult to chip off every particle of slag adhering to the burnt lining, but the more nearly complete the job is, the better the patch will be able to protect the lining during the next heat. If the slag is not removed, it will melt and carry the patch down with it. All holes in the lining should be plugged with brick or refractory patching mud described later. With proper cupola operation the scoring of the brickwork in the melting zone should be even and clearly defined.

Those foundries melting high tonnages of hot iron will find it necessary to use 9-in. by 6-in. by 4-in. cupola blocks for patching. Smaller foundries can use 9-in. straights, 1½-in. splits, or refractory daubing mud. Do not throw away the pieces of block removed from the lining, as they can be used in making daubing materials.

Daubing Mixtures

For many years the authors have emphasised the necessity of using good refractory daubing mud and yet still find some foundries which use river sand, moulding sand and other low fusing materials for this purpose. It is no surprise that these foundries always complain about not securing satisfactory service from their block linings. Daubing mud should be made from those materials which will actually preserve and protect the lining. Mixtures of fireclay with river sand or moulding sand will have a lower fusion point than either of the materials alone. Eutectics are formed in accordance with the principles of thermo-chemical mineralogy.

When such materials are used, the daubing melts down before the cupola reaches its full heat, the patching bricks are carried along with it, the brick lining has no protection, and thick, gummy slags are formed. A serious "bridge" may occur, the slag hole frequently becomes frozen, the melting goes off schedule and the iron may be of inferior quality. The right kind of daubing mud is highly important in conserving refractories.

There are nearly as many daubing mixtures as there are grey-iron foundries, but the following are recommended, as they give good service and help to preserve the lining:—

Formula No. 1.—Two parts white silica and (waste sand reclaimed from sand-blast machines is

* A Paper read before the St. Louis meeting of the American Foundrymen's Association. The authors are respectively Vice-President and Foundry Engineer, The Ironton Fire Brick Co.

Foundry Refractories

excellent for this purpose provided it does not contain too much iron scale) and one part plastic fireclay (fusion point at least Cone 26, 1,592 deg. C.).

Formula No. 2.—Six parts crushed firebrick, through 10-mesh riddle (old firebrick reclaimed from the cupola lining can be crushed by placing in a tumbling barrel containing a few pigs of iron), and four parts plastic fireclay (fusion point at least Cone 26).

The above compositions should be mixed dry, then thoroughly blended with enough water to make a stiff plastic mud, preferably in a muller mixer. Never use river sand, moulding sand, yellow loam or blue shale in daubing muds.

The Effect of Air Supply on Refractories

No attempt will be made to discuss the controversial subject of tuyeres, but it would be impossible to over-emphasise the importance of proper air supply. It is essential to see that the correct amount of air enters the cupola with the proper penetration. The blast pressure should be kept uniform and a good pressure gauge will soon pay for itself in increased efficiency. A pressure gauge alone is not sufficient, and it is highly desirable to use a volume gauge or one of the newer air controls to weigh the quantity of air going into the cupola. Excessive blast will oxidise the iron and this will cause severe cutting of the blocks in the melting zone.

The life of the melting zone lining is normally proportional to the melting zone temperature and the duration of the heat. It is useless and uneconomical to melt at a higher temperature than is actually required for the type of castings being made. The eyes of most foundrymen, as well as brickmakers, are unreliable and a good optical pyrometer is much better for measuring the temperature of the iron as tapped.

The Effect of Charging on Refractories.—The nature of the mixture used in the cupola and the method of charging has considerable bearing on the life of the lining. A high percentage of steel scrap with its higher melting temperature decreases the life of the brick in the melting zone. The scrap should be in small pieces so that it will not divert the blast against the lining. Careful charging will prolong the life of the lining in the abrasion zone.

The Effect of Slagging on Refractories

Proper slagging of the cupola is necessary in order to conserve the refractory lining. Very little consideration has been given to the fluxing materials used and little is known regarding their behaviour in a cupola. For example, fluorspar is a glassy mineral consisting of 51.1 per cent. calcium and 48.9 per cent. fluorine. It decrepitates or flies to pieces when heated and it melts at 1,405 deg. C., forming an enamel-like substance consisting principally of lime. It is very useful for thinning slags, but is extremely corrosive to the cupola lining if carelessly used.

Calcite, the primary mineral constituent of limestone consists of 66 per cent. lime and 33 per cent. of carbon dioxide. Those stones containing an appreciable amount of magnesia (15 to 20 per cent.) are considered as dolomite. Aragonite has the same chemical composition as calcite, but it flies to pieces when heated. Most of it may be blown out of the stack and it is useless as a fluxing stone.

When calcite and dolomite are heated in the cupola, they dissociate into carbon dioxide and lime or lime-magnesia mixtures. Dolomite is probably the more effective flux, although limestone is widely used. Whatever stone is used, it should be of high purity and of egg size. In charging, it should be kept about 6 in. away from the cupola lining, as lime and magnesia are corrosive to firebrick.

Cupola slag in itself is not particularly destructive to the lining unless it contains large amounts of metallic oxides, but the basic materials forming the slag (iron oxide, lime and magnesia) are corrosive. The slag should never be permitted to become stiff and gummy, but should be kept fluid and removed from the cupola as promptly as possible. The slag hole should not be permitted to become so large that the blast blows through it. A blast of slag will destroy slag-hole blocks. It is difficult to make a fireclay slag-hole block that will give the desired service in large production foundries. Some foundries, however, install two slag blocks side by side. They use one during the first half of a long heat, then mud it off, and complete the slagging operation with the other block. Silicon carbide blocks apparently give good service in large foundries, but they are expensive. Worn-out snagging wheels, if they are silicate bonded, can be used for slag holes by knocking out the arbour bushing. However, rubber-bonded and bakelite-bonded wheels are obviously not suitable for this job.

Cupola slags are extremely variable in composition, colour and physical properties. The easiest slag on the firebrick lining is the one of a greyish-green colour and hard compact structure. Bluish, foamy slags will indicate that considerable damage has been done to the lining. A careful examination of the slag each day will give much information on the operation of the cupola.

Many foundries now use fused soda ash as a supplemental flux in cupolas. This is good practice from the refractory standpoint, even though soda ash would be corrosive to firebrick if carelessly used. When properly used, soda ash improves combustion, is very effective in forming a fluid slag which can be quickly removed from the cupola, and, since it reduces oxidation, especially where large quantities of steel scrap are used, it actually helps to conserve the life of the lining.

The cupola lining can be preserved much longer than usual, provided the last charge is not coked and the blast is shut off as soon as a white heat is reached. More firebrick are "burned" in the cupola at this time than at any other period because the blast works directly on the lining. The blast is not needed after

(*Concluded on page* 110.)

CENTRIFUGAL CASTING

By G. F. ALEXANDER

This Paper deals with the casting of tubular pieces for the manufacture of internal combustion engine piston rings and cylinder liners, for which the author's firm have recently equipped their foundry with a James centrifugal casting machine built in the Union from drawings supplied under licence by the James Company, of Halesowen.

In this system of casting, the moulds—which are cylindrical in form, are rotated about a horizontal axis by which means a cylindrical core is formed in air, thus avoiding the necessity for making cores for each casting as in ordinary foundry practice, and eliminating the possibility of unsoundness due to "blowing" from the core.

In Fig. 1, item 1 represents the mould, item 2 the plunger which serves to seal the inner end of the

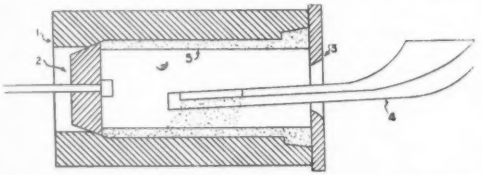


FIG. 1.—JAMES CENTRIFUGAL CASTING MACHINE. 1 MOULD; 2 PLUNGER; 3 FRONT PLATE; 4 SPOUT; 5 CENTRIFUGALLY CAST POT.

mould, and also to eject the finished casting, item 3 is the front plate which allows metal to be poured into the mould and also serves to regulate the bore of the casting, item 4 is the spout by means of which the metal is introduced into the mould, and item 5 shows a partly formed casting in process of being poured.

The James machine is designed with three shafts running one inside the other. The outer shaft carries the driving and braking mechanisms and the face plate to which the mould holder is fixed. Inside this slides a second shaft, to which is attached the front plate (3), which has to be moved out of the way in order to remove castings from the machine. Inside this is the plunger shaft, the function of which has already been described. The machine is driven by belt from a variable speed motor which provides an infinite range of speeds from 500 to 1,500 r.p.m. at the machine spindle. Limit switches on the electrical gear prevent any mistake in the sequence of the casting cycle or the possibility of running the spindle excepting when the front plate is securely in its working position.

To make castings the desired speed of rotation is selected on the motor controller, the front plate is brought into the working position; the motor is started, and the spout, which is on a hinged assembly, is swung forward until it enters well into the mould. Molten metal is then poured into the receiving basin at the outer end of the spout and runs into the mould until it is filled up to the level of the opening in the front plate, when any excess metal poured is thrown out and is caught by a sheet metal guard provided for that purpose. As soon as the metal has solidified the machine is stopped by means of a brake lever, the pouring spout is withdrawn and swung out of the way, and the mechanism (controlled by a servo motor) which removes the front plate is started up. The front plate and spout both being out of the way, there is nothing to prevent the removal of the casting from the mould; so as soon as the temperature of the casting falls to 900 deg. C., a hand wheel is turned which operates the plunger, moving it forward and so ejecting the casting. A reversing switch to the servo motor is then closed to bring the front plate to the operating position, the spout is swung back into position, the main motor is started, and we are ready to make another casting.

Unforeseen Difficulties

Actually, when the machine was started up early in the year, a large number of unforeseen difficulties were encountered. First of all, the castings were unsound, the trouble being due to cold shuts, though it was some time before they were recognised as such, as it was not apparent from the outside of the casting. Also it was not possible to produce metal to the chemical specification required. The two troubles were interconnected, and it was found that the real trouble was the inability to get the small amounts of metal, which the machine is able to take, hot enough from the cupola; the machine normally produces about 18 castings per hour, and the average weight of a casting may be put at 15 lbs.; therefore, on an average, only 250 to 300 lbs. of molten metal per hour is required. Even the smallest cupola will melt about 1,500 lbs. hourly, and the difficulties connected with tapping 10 to 20 lbs. every two or three minutes are readily imagined. Furthermore, all the piston-ring specifications acceptable for aircraft limit the carbon contents of the iron to below 3.5 per cent., and the cupola was delivering iron with 3.6 to 3.8 per cent. carbon. An attempt was made to limit the carbon by means of steel additions to the cupola charge, but this increased the difficulties with cold shuts enormously, and the management was forced to abandon the idea.

Eventually duplexing the metal was tried by melting a charge in the cupola, and transferring it to a crucible furnace for superheating, and at the same time making additions of steel, ferro-manganese, ferro-silicon and other alloying agents as required to bring the metal to correct chemical analysis.

Some idea of the difficulties associated with the metal specification may be gathered by an examination of typical piston-ring specifications. In the case of 4K6, which is the only alloy in which castings have been made in any quantity up to the present, a technique has been developed which gives metal of correct specification with gratifying regularity. The

* A Paper read before the South African Branch of the Institute of British Foundrymen.

Centrifugal Casting

use of steel in its make-up has been discarded, and, taking Iscor H2 pig molten from the cupola, the metal is first oxidised with 14 ozs. of Thabazimbi ore per 100 lbs. in the crucible furnace. When the "boil" is over, the carbon is reduced to 3.2 to 3.4 per cent., which is well within specification. Then sufficient ferro-phosphorus, ferro-manganese and ferro-silicon is added, and the temperature raised to not less than 1,350 deg. C., which is the minimum pouring temperature.

By this means the author has succeeded in producing B.S.S. 4K6 correct to specification, and the inspection reports show U.T.S. ranging up to 26 tons per sq. in., and E.N. up to 22 million lbs. per sq. in. The E.N. is a nominal value for Young's modulus for piston-ring materials calculated by a formula approved by the Air Ministry.

Another difficulty experienced, especially at the beginning, was with the extraction of the castings from the mould. This was caused by the solidification of a fin of the surplus metal around the front plate, making it impossible for the mechanism swinging it out of the way to function. In numerous instances men have had to cut away the fin with a cold chisel in order to free the front plate, by which time the casting has cooled down so much that chilling has taken place at its outer surface, to such an extent as to make it unmachinable. Hotter metal has very largely overcome this difficulty, and with experience in operating the machine the management has very largely overcome the troubles due to this cause.

SHORTAGE OF BINDERS

Dwindling supply of cereal binders threatened to curtail foundry operations soon in the United States, reported "Steel" at the end of June. Approximately 40,000,000 bushels of corn are ground annually to produce 75,000 tons of binders for use in preparation of cores and facing sands. Unfavourable weather, huge demand from war industries, Lend-Lease shipments, and a low corn price ceiling, in relation to hog prices, have brought about a serious corn shortage. Corn refiners and processors faced a complete shutdown.

Apparent substitutes for cereal binders that could be used in foundries include: the by-product of the sulphite paper process known as lignin, in liquid or powdered form; dextrin; synthetic resins; soya-bean meal and resin-base binders. To what extent these substitutes will be able to meet the enormous new demand has not yet been determined. Foundries normally carry from two to three weeks' supply of cereal binders in stock.

NOT BOTTLES OR BONES, BUT PAPER

CONSERVATION OF FOUNDRY REFRACTORIES

(*Concluded from page* 108.)

the stock turns white as the bed will melt any small amount of iron that may be left.

For cupola spouts the use of manufactured trough tile is recommended. They are easy to install, their use saves considerable labour, they prevent run-outs, they last much longer than ordinary firebrick or sand-clay mixtures and they give much cleaner iron.

Refractories for Ladles

Ladle refractories are just as important in the efficient operation of a foundry as any other refractory materials, and proper consideration should be given to them. In desulphurising ladles, regular firebrick fails rapidly, due to the corrosive action of soda ash and soda slags on the joints in the lining. The authors have found that rammed in, plastic refractory linings give the best and most economical service, provided the plastic is made from calcined fireclay instead of ground-up brickbats. Brick linings would be satisfactory if a suitable jointing material could be found.

Many foundries use brick linings in large ladles handling cupola iron. When these bricks are laid in suitable refractory bonding mortar, the life of the brick is lengthened considerably. Siliceous ramming refractories are coming into wide use for lining ladles handling cupola iron, malleable iron and electric furnace steel. This type of refractory is especially valuable in lining covered pouring ladles. The material is highly refractory, has low permeability, has high bond strength and is easily rammed into a solid, monolithic structure.

Circular fireclay discs, called ladle bottom tile, will prevent bottom run-outs, give a dry bottom, are easy to install and offer a substantial saving in labour costs. They last much longer than 9-in. straights and 1¼-in. splits.

RAMMING MIX FOR BASIC BOTTOMS

A magnesite ramming mixture for the construction of open-hearth and electric furnace bottoms, known as H-W Magnamix and requiring only the addition of sufficient water to bring it to the proper consistency for ramming has been developed by Harbison-Walker Refractories Company, Pittsburgh. It contains approximately 80 per cent. magnesia in the stable crystalline form, periclase, which has been established as the durable constituent of bottoms of dead-burned magnesite grains sintered into place. No slag is added to the material, hence there is no dilution of the high homogeneous magnesia content of the finished bottom. Ramming can begin as soon as the brickwork of the sub-bottom, frontwalls, backwalls and roof are completed, and can proceed simultaneously with the construction of ports and endwalls and repairs to regenerators. Complete open-hearth furnace bottoms, it is claimed, have been installed at the rate of over 2 tons per hour with less than 5 man-hours per ton.

THE EVIDENCE AND POWERS OF ATTORNEY ACT, 1943

As there is trade interest in the Evidence and Powers of Attorney Act, 1943 (with the 1940 Act of similar name) and many firms have members called up with powers of attorney required for those left, we give this short explanation, being also inclusive of all Orders and Orders in Council up to date.

This statute gives power to persons other than Commissioners of Oaths to administer oaths and take affidavits; thus Naval, Military and Air Force officers of the rank of Lieutenant Commander, Major, and Squadron Leader (and upwards) respectively can officiate; if of the staff of the Judge Advocate General, a Captain or Flight Lieutenant is high enough rank. This applies whether serving in the U.K. or outside the U.K., that is, for anyone in the Forces, and for any person while serving in any occupied territory.

In addition, as regards persons in any enemy or enemy-occupied country, certain British subjects can officiate, this provision being to cover prisoners of war and interned civilians. Thus a person who is the official representative of prisoners of war or other persons detained or interned can administer oaths and take affidavits, as can a member of the Colonial Legal Service or Colonial Administrative Service, a barrister, advocate or solicitor, or a Master of a British ship. This also applies as regards a branch manager (in this position immediately before September 3, 1939, for Europe or Africa; December 6, 1941, for any other country) of certain banks, to wit the Hong Kong and Shanghai Banking Corporation, the Eastern Bank, Limited, the Chartered Bank of India, Australia and China, and the Mercantile Bank of India, Limited. This provision will allow master mariners, camp leaders, non-commissioned officers, privates and so forth to officiate for oaths and affidavits.

Special provisions apply as regards powers of attorney, that is, for powers executed outside the U.K. by a member of the Navy, Army or Air Force or auxiliary forces or nursing services of the Forces mentioned, or by a British subject in enemy or enemy-occupied territories, so that for the instrument to have effect it must be attested by at least one witness and deposited in the control office of the Supreme Court (for Scotland registered in the books of council and session; for Northern Ireland deposited in the proper office of the Supreme Court). Airgraph photographic copies of powers of attorney and affidavits can be deposited or registered in pursuance of these obligations. It should be understood that the provisions just explained do not apply to ordinary powers of attorney, but to obviate any difficulty for a person requested to do certain things (*e.g.*, supply goods, etc.) by a donee, who may wish to know whether the instrument does come under these provisions, there should be a statement in writing (either contained in the power or otherwise) by the donor, that this is an ordinary power of attorney, not requiring these special formalities, the Act providing that this will be conclusive evidence of that fact.

WROUGHT LIGHT ALLOYS DEVELOPMENT ASSOCIATION

The second annual general meeting of the Wrought Light Alloys Development Association, held in Birmingham on September 15, was attended by representatives of each member company.

The statement of accounts for the year ending June 30, 1943, was presented and accepted.

In a short speech, Mr. H. W. Clarke, the chairman, summarised the work carried out by the association. In its capacity of a technical information bureau it had been successful in providing information and advice to a large number of firms who, for the first time, found themselves fabricating and manipulating aluminium alloys in all forms. The association's policy of developing its resources to assist the war effort had proved to be effective. Lectures on aluminium alloys, their manufacture and treatment, had been given in technical colleges, works and R.A.F. stations. The association had collaborated closely and acted as a channel for the industry in its contacts with the Ministry of Works Study Committees.

OBITUARY

MR. ARCHIBALD G. WALKER, of Walker Bros. (Wigan), Limited, died on September 24.

PROF. ARTHUR A. READ, Emeritus Professor of Metallurgy at the University College, Cardiff, died at his home at Bournemouth on September 24, at the age of 75. He was a D.Met. of Sheffield, an honorary D.Sc. of the University of Wales, and a Fellow of the Institute of Chemistry.

MR. WILLIAM SMITH, who was prominently identified with the industrial development of Motherwell for over 50 years, died recently. He was chairman and managing director of the Brandon Bridge Works until the works closed down after the last war. The works executed orders in many parts of the world. Mr. Smith was 86.

DESPITE WARTIME DIFFICULTIES there was an attendance of between 50 and 60 at the annual conference of foremen and metallurgists attached to the foundries of the British Meehanite licensees, which was held in Newcastle-upon-Tyne on September 30 and October 1. During the conference many subjects appertaining to the operation of the Meehanite process were discussed. The discussions were animated and in some cases prolonged, and members freely exchanged experiences in operating the process. The final session was devoted to a discussion on cupola and melting practice. At the conclusion of the technical sessions the members, by courtesy of the firm, visited the foundries of C. A. Parsons & Company, Limited.

NEWS IN BRIEF

MR. L. W. LAW, on being inducted as president of Birmingham Metallurgical Society, gave an address on "Our Debt to the Metallurgist."

BRITISH INSULATED CABLES, LIMITED, announce that the telegraphic address of their head office, works and all branch offices in Great Britain, Northern Ireland, and the Irish Free State is now "Bicobest."

THE NAME of Kryn & Lahy (1928), Limited, engineers and steel founders, of Coburn Works, Dunhams Lane, Letchworth, Herts, has been changed to K. & L. Steelfounders & Engineers, Limited.

IT CAN NOW BE REVEALED that the dismantling of the airship mooring tower at Cardington, by Cox & Danks, Limited, has been completed. This was accomplished well inside scheduled time. Some 300 tons of steel have been recovered.

DURING THE NINE MONTHS since the formation of the Wolverhampton Production Exchange, under the auspices of the Wolverhampton and District Production Committee, business amounting to £750,000 has been exchanged. This figure was disclosed at an informal luncheon of the Exchange at Wolverhampton, when Mr. A. Dyson, who gave the figure, added that there were upwards of 650 producers in the area who were subscribing members of the exchange.

THE EXECUTIVE COMMITTEE of the Federation of British Industries, recognising the importance of inquiries at present being undertaken by Sir Arnold McNair's committee into the supply and the training of teachers, emphasises the necessity of assuring a supply of teachers in technical schools and colleges having technical knowledge, up-to-date industrial experience and ability to teach. It has assured the committee of its most sympathetic consideration for any proposals calling for greater co-operation by industry in this matter.

UNITED STATES STEEL PRODUCTION rose during July to a total of 7,376,017 tons, but remained below the outputs in the preceding 31-day months of 1943, according to the American Iron and Steel Institute. July output was, however, substantially above the total for July, 1942, when 7,144,958 tons were produced. In June last production totalled 7,027,101 tons, having been depressed because of the coal strike. In the first seven months of 1943, a total of 51,242,929 tons of steel was produced, about 1,562,000 tons more than in the corresponding months of 1942.

THE BRUSH ELECTRICAL ENGINEERING COMPANY, LIMITED, and Metropolitan-Vickers Electrical Company, Limited, have fused their interests in the battery electric vehicle industry. The Brush Company, who have had extensive experience in the design and manufacture of bodies for passenger transport and other vehicles, have acquired the goodwill and business of the vehicle department of Metropolitan-Vickers. The Metropolitan-Vickers Company will still continue to manufacture the motors, controllers and electrical equipment, but the vehicle will be sold as the "Brush" electric vehicle.

PERSONAL

MR. H. B. ROBIN ROWELL, a director of R. & W. Hawthorn Leslie & Company, Limited, has been elected chairman in succession to the late Mr. E. C. Straker.

MR. JAMES CHRISTOPHER DACK, of Loftus, manager of the Kilton ironstone mine of Dorman Long & Company, Limited, is included in the new list of magistrates for the North Riding of Yorkshire.

MR. W. W. WOOD, of the Wardsend Steel Company, Limited, was re-elected Master Cutler of Sheffield last week. This is the fifth year Mr. Wood has been Master Cutler and the fourth year in succession.

MR. F. S. THOMPSON is to be the next mayor of Wolverhampton. He is chairman and joint managing director of Thompson Bros. (Bilston), Limited, Bradley Engineering Works, Bilston. Mr. Thompson has been a member of the Town Council for 20 years, and in 1939 was appointed an alderman.

MR. A. W. STEVEN, chairman of Allied Ironfounders, Limited, has intimated his desire to retire from the chairmanship of the company at the end of the year. The directors have appointed Mr. James Shaw, managing director, to the joint positions of chairman and managing director. Mr. Steven will remain a director of the company.

MR. H. O. MONKLEY, after 51 years' service with the Tredegar Iron & Coal Company, Limited, and its associated companies as secretary and London manager, retired on September 30. He has received gifts from the chairman and directors of the companies and his colleagues, with many expressions of goodwill. Mr. Alexander Grieve has been appointed secretary, in addition to his duties of chief accountant of the companies.

MR. G. E. WILSON has been appointed Divisional Chemist for Scotland in the research department of the L.M.S. Railway Company at St. Rollox, Glasgow. An Edinburgh man, from 1923 to 1927 he was demonstrator in inorganic chemistry and assisted in research work in organic chemistry under the late Prof. A. A. Boon in Edinburgh. In 1927, he was appointed to the L.M.S. chemical laboratory, St. Rollox, and in 1938 was transferred to Derby, where, in the following year, he was appointed acting senior assistant to the L.M.S. Midland Regional Chemist.

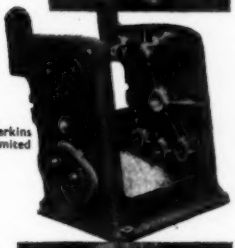
MR. W. M. LARKE, son of Sir William Larke, director of the British Iron and Steel Federation, has been appointed general manager of the Alfred Hickman branch, Bilston, of Stewarts and Lloyds, Limited, in succession to Mr. A. Wright, who has just retired. Mr. Larke joined Stewarts and Lloyds just over three years ago, when he was appointed chief engineer at the Alfred Hickman branch. Before that he had been departmental manager at the Stanton Ironworks, Nottingham, and had been with Dorman, Long & Company, Limited, at Middlesborough. After leaving Cambridge he served his time with the B.T.H. Company at Rugby.

STANTON DALE

Refined PIG IRON

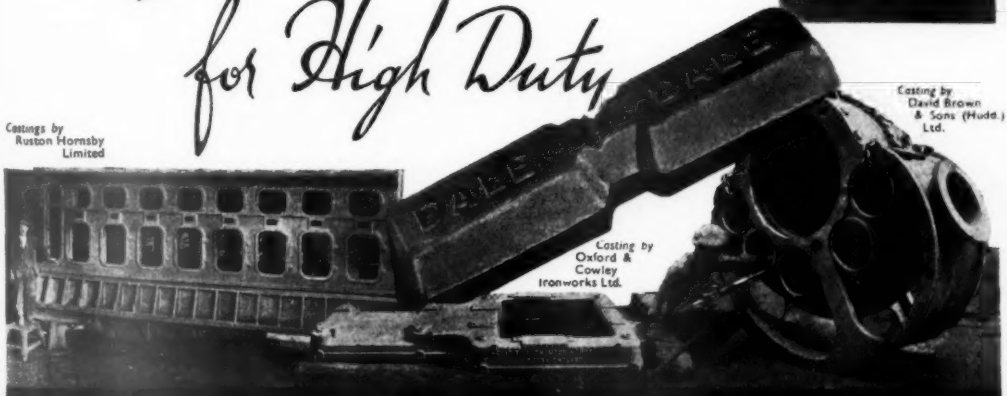
for High Duty

Castings by Morris Motors Limited.



Casting by Baker Perkins Limited

Castings by Ruston Hornsby Limited



Castings by Ruston Hornsby Limited

Casting by David Brown & Sons (Huddersfield) Ltd.

Casting by Oxford & Cowley Ironworks Ltd.

THE STANTON IRONWORKS COMPANY LIMITED
NEAR NOTTINGHAM.

COMPANY RESULTS

(Figures for previous year in brackets)

Manganese Bronze & Brass—Interim dividend of 7½% (same).

Ransomes & Rapier—Interim dividend of 2%, free of tax (same).

William Beardmore—Interim dividend of 3% on the ordinary stock (same).

Richardsons, Westgarth—Interim dividend on the ordinary shares of 4% (nil).

Cochran & Company, Annan—Dividend of 2½%, making 4%, tax free (same).

Callender's Cable & Construction—Interim dividend on the ordinary shares of 5% (same).

United Steel Companies—Dividend of 5½% (same), making 8% (same) for the year ended June 30.

Lancashire Steel Corporation—Half-yearly dividend on the 5% cumulative redeemable first preference stock for six months to October 31.

International Aluminium—Profit for 1942, after amortisation and N.D.C., £27,499 (£19,506); tax, £4,000 (£3,000); 7% preference dividend, £17,374 (same); forward, £17,663 (£13,938).

Electrolytic Zinc Company of Australasia—Dividend of 5% (same) on both the 8% cumulative participating preference and ordinary shares for the half-year ended June 30, 1943, making 9% (same) for the year.

Leeds Fireclay—Profit to June 30 last, £48,587 (£10,877); debenture interest, £8,588; preference dividend, £30,000 (nil); dividend on the ordinary shares of 4%, £4,000 (nil); to post-war renewals account, £5,000; forward, £26,957 (£25,958).

Darlington Railway Plant & Foundry—Profit for the year to April 30, £11,790; depreciation, £1,677; reserve for deferred repairs, £1,200; reserve for taxation, £5,500; 5% non-cumulative preference dividend, £325; ordinary dividend of 10%, £2,100; forward, £3,263.

United Gas Industries—Profit for the year ended March 31, £160,309 (£107,455); net balance after taxation, etc., £87,713 (£91,897); preference share dividend of 7%, £19,222; ordinary dividend of 12%, plus 3% bonus, £51,175 (total of 12%); dividend of 6d. per share (same), plus 9d. (nil) per share bonus, on the deferred shares, £17,060; forward, £12,996 (£12,740).

J. Blakeborough & Sons—Net profit for the year to June 30, after providing for depreciation, A.R.P., etc., £163,721 (£133,062); taxation, war damage contributions, interest on and provision for redemption of 7 per cent. cumulative notes, etc., £137,029; to general reserve, £10,000; ordinary dividend of 10% (same) and a bonus of 10% (same); forward, £12,578 (£10,276).

LORD RIVERDALE, head of the Sheffield steel and tool works of Arthur Balfour & Company, Limited, advocates a Ministry of Inventions so that inventions should not slip through our fingers as in the past. He said last week that there was a great future for Sheffield after the war if they looked after the new inventions, a great number of which had, in the past, been bought by Germany and America.

NEW PATENTS

The following list of Patent Specifications accepted has been taken from the "Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each.

555,475 DANIELS, LIMITED, T. H. & J., and DANIELS, J. L. Injection mechanism of die-casting machines.

555,505 SCOTTISH MACHINE TOOL CORPORATION, LIMITED, and CLEMENTS, A. B. Briquetting-machines.

555,536 HIRSCH, S. Bearing metal alloy.

555,547 AMALGAMATED DENTAL COMPANY, LIMITED, and WILDING, S. W. Production of models from plaster moulds.

555,587 GREY, J. A., and ELLIS, E. H. Heat-treatment of metals.

555,592 BIRMINGHAM ELECTRIC FURNACES, LIMITED, ROBIETTE, A. G. E., and HANCOCK, P. F. Preparation of gaseous atmospheres for use in heat-treatment furnaces.

555,602 WIGLEY, F. S. Crucible furnaces.

555,654 BIRMINGHAM ELECTRIC FURNACES, LIMITED, and ROBIETTE, A. G. E. Furnace linings.

555,720 CLAVEL, A. Method of soldering foils of aluminium and aluminium alloys and a solder for use in such method.

555,724 PERMOLD COMPANY. Multi-section cores and permanent moulds.

555,729 TRIGGS, W. W. (Carnegie-Illinois Steel Corporation). Apparatus for handling strip of magnetic material.

555,730 HALLIMOND, A. F. Apparatus for the separation of particles by flotation.

555,734 BURRAGE, L. J., MEAD, A., and IMPERIAL CHEMICAL INDUSTRIES, LIMITED. Manufacture of magnesium.

NEW COMPANIES

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London W.C.2.)

F.B. & M. (Engineers)—£10,000. G. S. Fowler, 15, Nutfield Gardens, Ilford, subscriber.

H. Bragman, 261, Lavender Hill, London, S.W.17—Metal workers, engineers, etc. £1,000.

Stable Arc Welding Company—£1,000. A. Sansom and J. F. Johnson, 11, Elaine Avenue, Stroud, Kent.

Turnerson (Sparkbrook), 55, Stratford Road, Sparkbrook, Birmingham—Ironfounders, mechanical, electrical and agricultural engineers, etc. £5,000. W., A. T., and A. C. Turner.

Alibyn Products, 14, Greyhound Lane, London, S.W.16—To acquire inventions relating to solder, welding rods, jointing and insulating materials, and fluxes, etc. £1,000. H. O. Ormiston and B. E. Thompson.

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Raw Material Markets

IRON AND STEEL

While there has been some improvement in the imports of foreign ores, available supplies fall considerably short of the tonnages required for the blast furnaces and the bulk of the material smelted consists of low-grade native ironstone. This, of course, is reflected in the outputs. There is an abundance of high-phosphorus iron and a scarcity of hematite and irons with a low or medium content of phosphorus. Distribution of these grades continues, therefore, to be carefully controlled and engineering foundries are using wherever possible high-phosphorus grades, refined iron and scrap. It has to be recorded, however, that the last few weeks have witnessed a distinct improvement in the supply position of low- and medium-phosphorus grades, which are now more readily available than for a couple of years past. The steel-foundries and ironfoundries engaged on the heavier classes of castings are very busy, and in the light foundries there has recently been a slight increase in the volume of work in hand.

A constant feature of the steel trade is the urgent demand for plates of every description. Every plate mill is in continuous operation; some of the sheet mills are also employed in rolling thin plates, and stocks of American plates are also being drawn upon —principally for use in the pre-fabricating shops. Nevertheless, in spite of the increasing strain imposed upon this branch of the industry, it is difficult to keep pace with the manifold requirements of the shipbuilders and boiler makers, engineers, tank, locomotive and wagon builders. The mills are indicating extended delivery dates, and the arrangement of priorities is a task of considerable complexity. Section mills are also busily employed, with interest chiefly concentrated on light and medium sizes, and big tonnages of sheets—nearly all black or painted—are required for a wide variety of purposes, ranging from the heavier gauges for the shipyards to thin sheets for hutments, containers, etc. There is a sustained demand for railway and colliery equipment. Wire drawers and rivet and bolt makers are turning out maximum production, and the mounting output of aircraft calls for big tonnages of special and alloy steels.

NON-FERROUS METALS

Supplies of non-ferrous metals continue to be promptly forthcoming against licences to acquire. Success of the Allied campaign against the U-boat is reflected in the more favourable position of the Allies' stocks of copper. The latest report of the Combined Copper Committee in Washington shows that the new supply of copper is now roughly equal to the present actual consumption of the United Nations. Demand as forecast some months back, the report says, necessarily took into account the possibility of heavy sinkings of ships carrying ore and copper products. The position in this respect has recently much improved.

Battlefield scrap is another increasingly important factor in the problem of copper supply. Collection of copper scrap in the U.S. may also exceed previous expectations. Shipments from Africa to the United Kingdom have been speeded up.

A recent announcement by an official of the U.S. Department of Mineral Resources indicates that as much as 27 cents per lb. is being allowed to certain small copper producers in Arizona as an encouragement to them to keep their properties in production.

A big saving of tin consumption in the United States was effected during the first half of this year as a result of the increasing use of lightly coated tinplate. Tinplate output was 1,085,810 short tons in the six months, and only 10,000 tons of tin were absorbed in tinplate production.

Comment on the existing method of taxation of the Cornish tin-mining industry is made by Mr. G. W. Simms, chairman of Geevor Tin Mines, Limited, in a statement accompanying the annual report of the company. Mr. Simms says that taxation is a question of vital importance to the future of Cornish mining. The existing method, which is long out of date, insists on treating all expenditure on shaft sinking as of a capital nature, and makes no allowance for the wasting nature of the assets which are being constantly depleted. Mr. Simms states that while these hardships remain it is extremely difficult to maintain the present level of production in Cornwall, for there is no encouragement to new mining enterprise.

It is reported that Bolivian tin exports during the first half of the year totalled only 18,399 metric tons, against 19,415 tons in the corresponding period of last year and 21,423 tons in the first six months of 1941.

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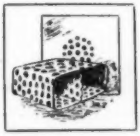

THE EVOLUTION OF THE FOUNDRY PATTERN

In human progress, the originators have been few, the imitators have been legion ; yet out of the imitative characteristic has arisen the vast increase in articles of everyday life, which, in modern times has culminated in our mass production methods. Our remote forbears, having originated a stone implement, or, less remotely, a bronze implement, doubtless taught the art of fabricating it, by using it as a model and having it copied by the craftsmen to be. It may well be supposed that improvements in methods were very very slow, and indeed it is indisputable that only in quite recent times has production of articles by such scientific procedure as repetition casting received notable impetus. The provision of enduring patterns in metals, or such materials as Cummingstone, a hard marble-like substance capable of producing thousands of castings from the one pattern, has greatly helped in this development whereof the ultimate result is a better article at a much reduced cost. Cummingstone is manufactured and sold by Wm. Cumming & Co., Ltd., at their various works at Glasgow, Falkirk, Chesterfield, Deepfields and Middlesbrough.

FAH

CURRENT PRICES OF IRON, STEEL AND NON-FERROUS METALS

(Delivered, unless otherwise stated)

Wednesday, October 6, 1943

PIG-IRON

Foundry Iron.—CLEVELAND No. 3: Middlesbrough, 128s.; Birmingham, 130s.; Falkirk, 128s.; Glasgow, 131s.; Manchester, 133s. DERBYSHIRE No. 3: Birmingham, 130s.; Manchester, 133s.; Sheffield, 127s. 6d. NORTHANTS No. 3: Birmingham, 127s. 6d.; Manchester, 131s. 6d. STAFFS No. 3: Birmingham, 130s.; Manchester, 133s. LINCOLNSHIRE No. 3: Sheffield, 127s. 6d.; Birmingham, 130s.

(*No. 1 foundry 3s. above No. 3. No. 4 forge 1s. below No. 3 for foundries, 3s. below for ironworks.*)

Hematite.—No. 1 (S & P 0.03 to 0.05 per cent.): Scotland, N.-E. Coast and West Coast of England, 138s. 6d.; Sheffield, 144s.; Birmingham, 150s.; Wales (Welsh iron), 134s. East Coast No. 3 at Birmingham, 149s.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, 140s. 6d., delivered Birmingham.

Scotch Iron.—No. 3 foundry, 124s. 9d.; No. 1 foundry, 127s. 3d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, 174s.; South Zone, 176s. 6d.

Refined Malleable.—North Zone, 184s.; South Zone, 186s. 6d.

Cold Blast.—South Staffs, 227s. 6d.

(NOTE.—*Prices of hematite pig-iron, and of foundry and forge iron with a phosphoric content of not less than 0.75 per cent., are subject to a rebate of 5s. per ton.*)

FERRO-ALLOYS

(*Per ton unless otherwise stated, basis 2-ton lots, d/d Sheffield works.*)

Ferro-silicon (5-ton) lots.—25 per cent., £21 5s.; 45/50 per cent., £27 10s.; 75/80 per cent., £43.

Ferro-vanadium.—35/50 per cent., 15s. 6d. per lb. of V.

Ferro-molybdenum.—70/75 per cent., carbon-free, 6s. per b. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, 1s. 3½d. lb.

Ferro-tungsten.—80/85 per cent., 9s. 8d. lb.

Tungsten Metal Powder.—98/99 per cent., 9s. 9½d. lb.

Ferro-chrome.—4/6 per cent. C, £59; max. 2 per cent. C, 1s. 6d. lb.; max. 1 per cent. C, 1s. 6½d. lb.; max. 0.5 per cent. C, 1s. 6¾d. lb.

Cobalt.—98/99 per cent., 8s. 9d. lb.

Metallic Chromium.—96/98 per cent., 4s. 5d. lb.

Ferro-manganese.—78/98 per cent., £18 10s.

Metallic Manganese.—94/96 per cent., carb.-free, 1s. 9d. lb.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms and Slabs.—BASIC: Soft, u.t., 100-ton lots, £12 5s.; tested, up to 0.25 per cent. C, £12 10s.; hard (0.42 to 0.60 per cent. C), £13 17s. 6d.; silico-manganese, £17 5s.; free-cutting, £14 10s. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £15 15s.; case-hardening, £16 12s. 6d.; silico-manganese, £17 5s.

Billets, Blooms and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £13 17s. 6d.; basic hard, 0.42 to 0.60 per cent. C, £14 10s. 6d.; acid, up to 0.25 per cent. C, £16 5s.

Sheet and Tinplate Bars.—£12 2s. 6d., 6-ton lots.

FINISHED STEEL

[*A rebate of 15s. per ton for steel bars, sections, plates, joists and hoops is obtainable in the home trade under certain conditions.*]

Plates and Sections.—Plates, ship (N.-E. Coast), £16 3s.; boiler plates (N.-E. Coast), £17 0s. 6d.; chequer plates (N.-E. Coast), £17 13s.; angles, over 4 un. ins., £15 8s.; tees, over 4 un. ins., £16 8s.; joists, 3 in. × 3 in. and up, £15 8s.

Bars, Sheets, etc.—Rounds and squares, 3 in. to 5½ in., £16 18s.; rounds, under 3 in. to ⅜ in. (untested), £17 12s.; flats, over 5 in. wide, £15 13s.; flats, 5 in. wide and under, £17 12s.; rails, heavy, f.o.t., £14 10s. 6d.; hoops, £18 7s.; black sheets, 24 g. (4-ton lots), £22 15s.; galvanised corrugated sheets (4-ton lots), £26 2s. 6d.; galvanised fencing wire, 8g. plain, £26 17s. 6d.

Tinplates.—I.C. cokes, 20 × 14 per box, 29s. 9d., f.o.t. makers' works, 30s. 9d., f.o.b.; C.W., 20×14, 27s. 9d., f.o.t., 28s. 6d., f.o.b.

NON-FERROUS METALS

Copper.—Electrolytic, £62; high-grade fire-refined, £61 10s.; fire-refined of not less than 99.7 per cent., £61; ditto, 99.2 per cent., £60 10s.; black hot-rolled wire rods, £65 10s.

Tin.—99 to under 99.75 per cent., £275; 99.75 to under 99.9 per cent., £276 10s.; min. 99.9 per cent., £278 10s.

Spelter.—G.O.B. (foreign) (duty paid), £25 15s.; ditto (domestic), £26 10s.; "Prime Western," £26 10s.; refined and electrolytic, £27 5s.; not less than 99.99 per cent., £28 15s.

Lead.—Good soft pig-lead (foreign) (duty paid), £25; ditto (Empire and domestic), £25; English, £26 10s.

Zinc Sheets, etc.—Sheets, 10g. and thicker, ex works, £37 12s. 6d.; rolled zinc (boiler plates), ex works, £35 12s. 6d.; zinc oxide (Red Seal), d/d buyers' premises, £30 10s.

Other Metals.—Aluminium, ingots, £110; antimony, English, 99 per cent., £120; quicksilver, ex warehouse, £68 10s. to £69 15s.; nickel, £190 to £195.

Brass.—Solid-drawn tubes, 14d. per lb.; brazed tubes, 16d.; rods, drawn, 11¾d.; rods, extruded or rolled, 9d.; sheets to 10 w.g., 10¾d.; wire, 10¾d.; rolled metal, 10¼d.; yellow metal rods, 9d.

Copper Tubes, etc.—Solid-drawn tubes, 15¼d. per lb.; brazed tubes, 15¾d.; wire, 10d.

Phosphor Bronze.—Strip, 13¾d. per lb.; sheets to 10 w.g., 14¾d.; wire, 16d.; rods, 16d.; tubes, 21¼d.; castings, 19d., delivery 3 cwt. free. 10 per cent. phos. cop. £35 above B.S.; 15 per cent. phos. cop. £43 above B.S.; phosphor tin (5 per cent.) £40 above price of English ingots. (C. CLIFFORD & SON, LIMITED.)

Nickel Silver, etc.—Ingots for raising, 10d. to 1s. 4d. per lb.; rolled to 9 in. wide, 1s. 4d. to 1s. 10d.; to 12 in. wide, 1s. 4½d. to 1s. 10½d.; to 15 in. wide, 1s. 4¾d. to 1s. 10¾d.; to 18 in. wide, 1s. 5d. to 1s. 11d.; to 21 in. wide, 1s. 5¼d. to 1s. 11¼d.; to 25 in. wide, 1s. 6d. to 2s. Ingots for spoons and forks, 10d. to 1s. 6¼d. Ingots rolled to spoon size, 1s. 1d. to 1s. 9¼d. Wire round, to 10g., 1s. 7¼d. to 2s. 2¼d., with extras according to gauge. Special 5ths quality turning rods in straight lengths, 1s. 6¼d. upwards.

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